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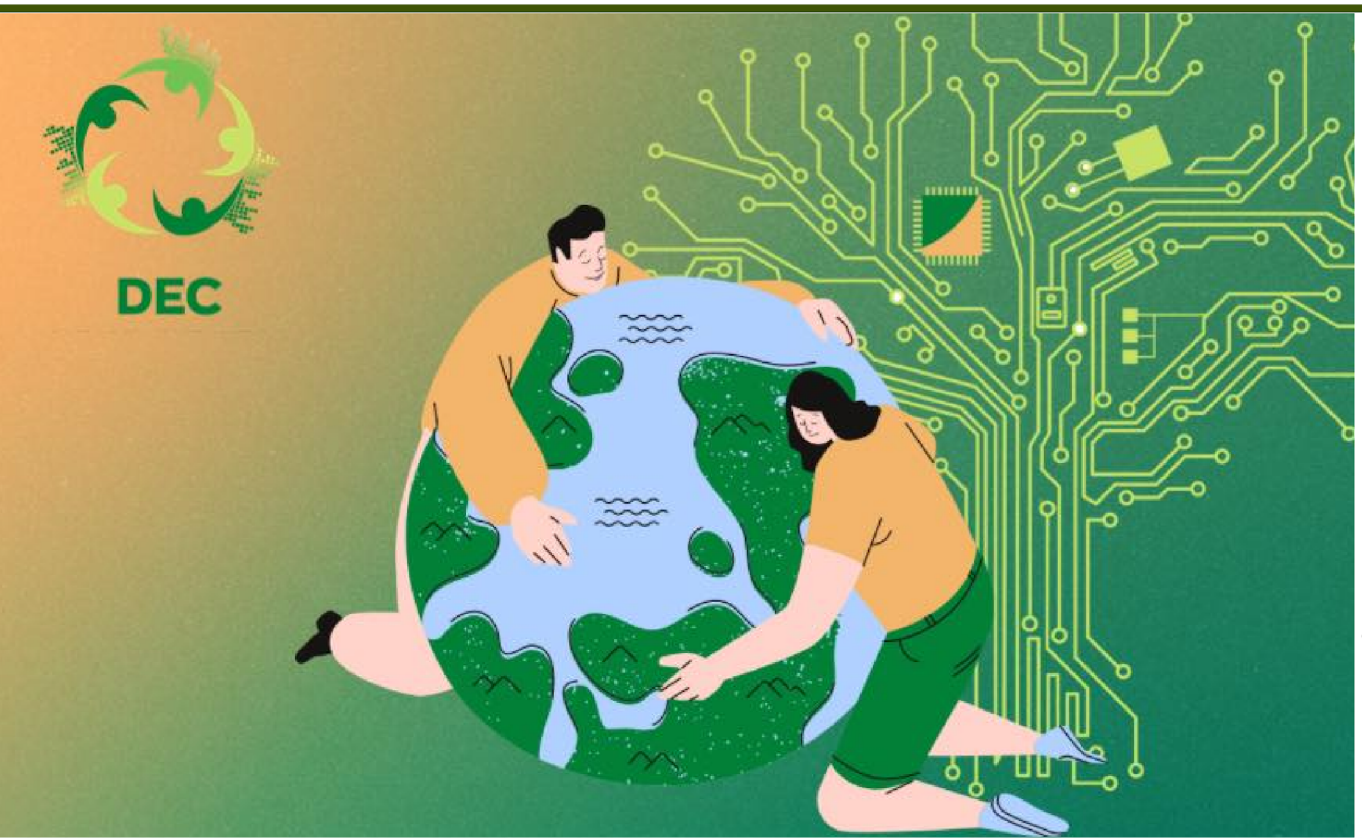
DEC

ENVIRONMENTAL AND DIGITAL CITIZENSHIP:
FOSTERING YOUTH ENGAGEMENT FOR
A SAFER ENVIRONMENT AND
RESPONSIBLE USE OF ICT

DEC POLICY BRIEFS

by the DEC Project's participants

An Erasmus+ Project



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About the DEC Project

The project's main objective is to strengthen young people's identity and sense of participation in social life through awareness raising on the environmental footprint, the digital age and its proper use, and to link the needs of young people to the political arena. Our vision is for youth to feel like an integral part of society, and to increase their understanding of the importance of participating and taking action as active citizens. The goal is to change the acumen and perspective of youth for civic participation and to further strengthen them towards vigorously pursuing their positions and their trust in the democratic society.

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ENVIRONMENTAL AND DIGITAL CITIZENSHIP: FOSTERING YOUTH ENGAGEMENT FOR A SAFER ENVIRONMENT AND RESPONSIBLE USE OF ICT

Alternative Approaches to Plastic Production and Recycling Policies

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Abstract

Plastics offer convenience to businesses and the supply chain, but their improper disposal and low recycling rates pose significant environmental and health challenges. Each year, millions of tonnes of plastic end up in oceans, with a recycling rate below 9%. Thus, urgent action is required to tackle this global plastic crisis. This policy brief proposes a Europe-wide ban on colored plastics to promote a circular economy and enhance plastic recycling, drawing insights from successful recycling policies in Japan and South Korea. This approach, despite initial challenges, can yield long-term benefits such as reduced exports, energy conservation, and increased consumer awareness. Collaboration, funding, and material design innovation are key to promoting sustainable practices and combatting plastic pollution. By seizing this opportunity collectively, we can make a lasting impact in the fight against plastic pollution and address the climate crisis before it's too late.

Keywords: Plastic, Recycling, Circular Economy, Sustainable Development

Introduction

Plastics are widely recognized for their multiple benefits, such as being cheap, durable, and versatile. However, these very qualities can also lead to negative impacts on the environment and human health when plastics aren’t properly disposed of. The enormous amount of production and the lack of proper recycling exacerbate the problem, highlighting that even if plastics are properly disposed of, a significant issue persists. Research indicates that every year 14 million tonnes of plastic end up in oceans (International Union for Conservation of Nature, 2021). The plastic epidemic is a global issue, with over 300 million tonnes of plastic produced each year and less than 9% of it being recycled (Plastic Oceans, 2021). Out of this amount, packaging makes up more than 40% of the world’s total plastic usage, with less than 14% of plastic packaging being recycled on a global scale (Ellen MacArthur Foundation, 2022).

The UN has encouraged nations to significantly reduce plastic by 2030. Retailers are now trying to improve their plastic footprint by using alternative packaging, but this is not enough. Businesses need to find ways to reuse and recycle products in order to eliminate waste and pollution. The design phase of a product ultimately plays the biggest part in combating plastic pollution, as it accounts for up to 80% of its environmental impact (European Commission, 2020, 3).

This policy brief examines the EU's plastic recycling situation and uses Japan and Korea as case studies. We propose a ban on colored plastics as the initial step toward long-term plastic recycling and waste management solutions. Our goal is to facilitate the recycling process, establish good practices, raise consumer awareness, and pave the way for a sustainable circular economy.

Literature Review

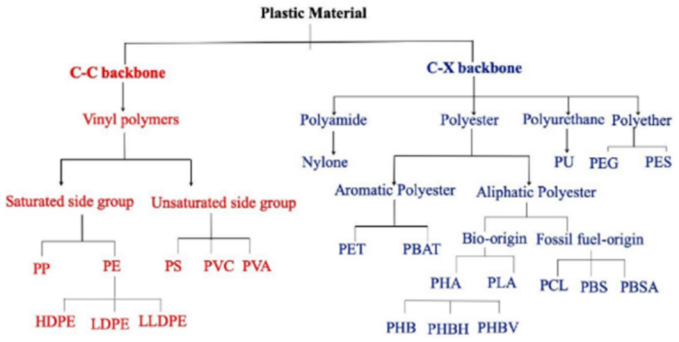
Overview of Plastics

Nowadays, a diverse range of plastics exists, customized to meet specific requirements. Understanding plastic types is crucial, as it facilitates recycling, and provides insights into the potential health hazards linked to plastic materials. Each plastic type has different properties and uses, and some are more easily recyclable than others. Thus, proper disposal of plastic is crucial in the prevention of harming the environment and its ecosystems. The seven types of plastic, according to Hardin (2021) are:

1. Polyethylene Terephthalate (PET or PETE): one of the most common types of plastic, due to its lightweight, strength, and transparency. It is mostly used as food packaging (beverage bottles, food bottles), fabric, and rope.
2. High-Density Polyethylene (HDPE): strong and resistant to chemicals and moisture, making it appropriate for cartons, containers, and other building materials.
3. Polyvinyl Chloride (PVC or Vinyl): highly resistant to chemicals, hard and rigid. Often used in construction and medical applications, even though it is considered the most dangerous for human health.
4. Low-Density Polyethylene (LDPE): compared to HDPE, is softer, clearer, and more flexible. It is mostly used as plastic wrap.
5. Polypropylene (PP): the most durable, as it is heat resistant, and flexible, retaining its shape and strength. It is also used as a hot food container.
6. Polystyrene (PS or Styrofoam): insulates well, while it is rigid and low cost. Found mostly in takeout food containers.
7. Other: other or a mixture of the above. These can't be recycled. Examples include CDs, electronics, etc.

Plastics are important in the supply chain for various reasons (Pilz et al., 2010). Their durability and versatility make them ideal for packaging and transportation needs, as they can be customized to suit different products and applications. Compared to materials like glass or metal, plastics are cost-effective, due to their lower price. Moreover, their lightweight nature facilitates efficient transportation, enabling mass transportation and thus reducing transportation costs. Plastics offer extended shelf life and protection during transportation and storage by acting as a barrier against moisture, oxygen, and contaminants, ensuring the safety and longevity of food products (British Plastics Federation, n.d.).

Figure 1: The hierarchical classification of plastic types based on the atomic composition of the main backbone



Source: Malik et al. (2023)

Colored plastics are used mainly for branding and product differentiations, to appeal to customers' preferences and make them recognizable(Spence & Velasco, 2018). Various pigment families are utilized to color plastics, including organic pigments, inorganic pigments, carbon black, white pigments, special effect pigments, aluminum pigments, and others. Among these, inorganic pigments pose a particular concern as they are insoluble, potentially becoming a significant source of microplastic pollution.

The use of inorganic pigments in plastic manufacturing raises environmental considerations due to their limited recyclability, biodegradability and potential long-term accumulation in the environment (SpecialChem, 2018). This highlights the need for sustainable alternatives and the adoption of practices that minimize the release of microplastics, such as replacing colored plastics with their clear counterparts.

As plastic waste is a significant concern, recycling certain plastics is pivotal in achieving a circular economy and reducing the environmental impact of plastic packaging. It plays a crucial role in mitigating harm to the environment and promoting sustainable practices in plastic material usage.

Circular Economy and Plastics

A circular economy is an economic system that minimizes waste and maximizes resource sustainability through continuous resource cycling. It promotes sustainable production, consumption, and economic growth while reducing environmental impact (McGinty, 2021).

To achieve a circular economy for plastic, three actions are necessary: eliminating unnecessary plastics, innovating reusable and recyclable materials, and ensuring the circulation of plastic items to minimize environmental harm (Ellen MacArthur Foundation, 2022). The EU has implemented measures, initiatives, and programs to address plastic sustainability concerns and promote the circular economy for plastics. This includes considering the entire product lifecycle and adopting strategies for sustainable production and consumption (European Parliament, 2018, 1).

Plastics and Circularity in the EU

According to (European Parliament, 2018), plastic production worldwide has increased significantly over the years. Specifically, the amount of plastic waste has grown from 1.5 million tonnes, as observed in the year 1950, to 359 million tonnes in 2018. Despite the EU's efforts to reduce plastic waste, challenges persist in achieving efficient plastic recycling. Complications arise from factors such as the price and quality disparities between recycled and unrecycled products. Additionally, the diverse composition of plastic's raw materials further impedes the recycling process, resulting in increased costs and potential compromises in the final product's quality.

Nevertheless, the EU has developed a comprehensive strategy, proposed by the European Commission, to address plastic waste. This strategy aims to ensure the reuse or recycling of plastic packaging by 2030, aligning with the directives of the Green Deal (European Commission, 2019). To support this goal, the European Parliament adopted legislation in 2015 that restricts the use of lightweight plastic bags in the EU and promotes their replacement with environmentally friendly alternatives like compostable and biodegradable bags.

In 2019, the EU implemented new rules targeting the issue of marine litter, which currently exceeds 150 million tonnes in our oceans (The European Parliament and the Council of the European Union, 2019). As marine litter poses risks to marine life and causes economic losses in sectors such as tourism and fisheries, EU lawmakers decided to ban single-use plastics such as cotton bud sticks and straws to prevent further ocean pollution. Furthermore, in 2022, the European Commission proposed new rules concerning packaging, promoting the use of bio-based and recycled plastics, as well as the improvement of packaging design (European Commission, 2022). MEPs also agreed to ban the use of microplastics in personal care and cleaning products. Finally, in early 2023, the European Parliament expressed its stance on waste shipment regulations, advocating for the cessation of exports to non-OECD countries and a phased-out approach within four years, emphasizing the importance of recycling (European Parliament, 2023).

Case Studies: Japan and S. Korea

The goal of this case study is to investigate noteworthy plastic recycling policies, while simultaneously conducting an analysis of sub-optimal practices. Japan and South Korea are two great examples in this regard.

Plastic Recycling in Japan

Japan's plastic waste management performance is notable, as evidenced by its high Plastic Management Index (PMI) of 84.5 out of 100, the second highest globally, according to the Economist's Impact(Economist Impact, 2021). Additionally, Japan achieved an impressive PET bottle recycling rate of 86% in 2021 (Tiseo, 2023).

The country has embraced Extended Producer Responsibility (EPR), an environmental policy approach defined by the OECD, which extends a producer's responsibility for a product to the post-consumer stage (OECD, 2001). In Japan, EPR was introduced through the "Packaging Recycling Act" in December 1995 (Yamakawa, 2016). The act assigns specific roles to stakeholders: consumers are accountable for source sorting, municipalities handle sorted collection, and producers bear the responsibility for recycling, while each stakeholder has physical and financial obligations. The government actively promotes public awareness through education and initiatives like strategically placed PET bottle collection points, encouraging individuals to process their waste at home(García, 2020).

However, despite these efforts, Japan faces challenges in overall plastic waste management. Its plastic waste per capita in 2022 was 32.4 kg, second only to the US (40 kg) (Dickella Gamaralalage et al., 2022). In 2017, Japan was among the world's highest-rated exporters, exporting 1431.45 million kilograms of plastic waste (Klein, 2023). Moreover, the predominant method of plastic waste disposal in Japan is incineration, accounting for 75% in 2019, which contributes to greenhouse as emissions, which severely contributes to climate change (Klein, 2022).

Plastic Recycling in S. Korea

The Republic of Korea first introduced EPR policies in 1992 through the Law for Promotion of Resources Saving and Reutilization (LRSR), which emphasized the legal role of the producers (Institute for Global Environmental Strategies, 2009). This law established the Producer Deposit Refund (PDR) system, operating under the deposit-refund principle to incentivize recycling. In 2003, the LRSR was amended, introducing the Producer Responsibility (PR) system, which sets Mandatory Recycling Targets (MRTs) for manufacturers based on packaging materials. Producers failing to meet obligations face recycling fees, while those exceeding obligations can carry over results for up to two years(Kim, 2010).

According to Statista in 2017 the Republic of Korea recycled approximately 22.7% of plastic waste as material and 39.3% as energy (SEA Circular, 2020). However, a 2016 survey by Statistics Korea revealed that the country had the highest plastic consumption per capita globally for that specific year, at 98.2 kg (SEA Circular, 2020).

Takeaways

Our case study highlights that Japan stands out in PET plastic bottle recycling. However, Japan faces challenges in overall plastic waste management, including high per capita plastic waste generation and reliance on incineration. Meanwhile, South Korea has achieved commendable recycling rates for plastic waste, despite its high plastic consumption per capita. Also, both countries have implemented Extended Producer Responsibility (EPR) policies to manage post-consumer plastic waste.

The overall effectiveness of PET bottle recycling implies that clear plastics facilitate the recycling

process, ultimately reducing plastic waste. Although colored plastic handling is not explicitly mentioned in our findings, the success of bottle recycling shows the potential benefits of promoting clear plastic packaging and implementing a ban on colored plastics. This strategic approach could offer a valuable solution to enhance plastic recycling efforts and minimize plastic waste, leading to a circular and sustainable supply chain.

Policy Recommendations

The literature review and the case studies provide valuable insights into the current state of plastic disposal and recycling practices across the globe. To establish sustainable solutions for plastic waste management, it is vital to tackle harmful practices like overconsumption and the prevalent use of incineration and landfilling for end-stage plastics. By analyzing both successful and unsuccessful cases, we can embrace effective practices and steer clear of pitfalls, thereby solidifying our efforts toward sustainability.

The majority of plastics produced today are used for packaging, with colored plastics being particularly prevalent. To align with the Green Deal's target of recycling at least 55% of plastic packaging waste by 2030 (European Commission, 2019), we propose a Europe-wide ban on colored plastics used in packaging, targeting vibrant hues that pose challenges for effective recycling. This ban aims to drive a shift towards clear or transparent plastics, ensuring greater recyclability and reducing the need for additives that hinder the recycling process. The resulting color uniformity in plastic packaging is grounded in the principles of Extended Producer Responsibility (EPR), emphasizing the manufacturer's role during the production stage in facilitating subsequent recycling.

Implementing a ban on colored plastics for packaging would have far-reaching implications across the production and distribution supply chain. While initial challenges and potential negative effects on employment and production may arise, the ban offers opportunities for import savings and reduced energy consumption. Additionally, it promotes consumer awareness of eco-friendly practices, laying a solid foundation for future actions. This approach aligns with international programs and government standards, including NATO's recommendations for green economic systems (NATO, 2021; 2022). Therefore, it is vital to secure funding and industry support during the transition towards modern, sustainable, and affordable materials. Recognizing the benefits of the production deal, we strongly advocate for the swift implementation of the ban, allowing sufficient restructuring time for supply chain actors. If executing a tender is deemed excessively costly, it may involve goods not yet manufactured or pending purchases of fibers and additives.

It is important to emphasize that this approach also serves as a protective measure for the marine biome and public health. Microplastics, insoluble in nature, result from the decomposition of plastic waste when it enters the oceans. By implementing our proposal, we contribute to safeguarding the marine ecosystem and mitigating the risks associated with consuming seafood and fish that have been exposed to microplastics (United Nations Environment Programme, 2021).

The commitment to the environment and the implementation of relevant regulations are topics of intense debate. Urgency is fueled by the imminent climate crisis, demanding swift legislative action. The proposed ban, which entails a significant transformation of the entire production system and brings forth noticeable changes in product appearance, can yield substantial effects. By promoting sustainable practices and actively engaging consumers, we can significantly amplify the benefits and raise awareness about the importance of the transition.

Conclusions

Plastics offer convenience in various industries, but their improper disposal and low recycling rates cause significant environmental and health problems. Millions of tonnes of plastic reach our oceans annually, with less than 9% being recycled. Urgent action is crucial in order to tackle this global plastic crisis. Governments, businesses, and individuals must swiftly adopt sustainable practices and eco-friendly alternatives to combat plastic pollution and address the urgency of the climate crisis

The study of plastic recycling policies in Japan and South Korea underscores the overall effectiveness of PET bottle recycling, which suggests that clear plastics facilitate the recycling process. These findings emphasize the importance of comprehensive approaches involving all stakeholders, including the successful implementation of Extended Producer Responsibility (EPR) policies, public education, and infrastructure development.

Our proposal for a Europe-wide ban on colored plastics is a practical solution to promote a circular economy and improve plastic recycling. Despite initial challenges and sector-specific impacts, the ban can lead to long-term benefits such as reduced imports, energy conservation, and increased consumer awareness of sustainability. Adopting the ban and fostering a circular economy will pave the way for a greener future. Through collaboration, funding, and material design innovation, we can significantly reduce plastic waste, protect ecosystems, and ensure a healthier planet for future generations. It is crucial to seize this opportunity and work collectively to achieve a lasting impact in the fight against plastic pollution.

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Water Pollution and Children's Health

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Abstract

Water is the basic element for human survival and plays an important role to sustainable and socio-economic development, energy and food production, the preservation of healthy ecosystems. However, it is neglected, misused and undervalued as society does not protect it from various threats, climate change and pollution. The latter has affected freshwater sources, followed by an impact to children, as they are extremely sensitive to pollution. Most relevant water contaminants that affect are lead, pesticides, arsenic, perchlorate and nitrates. Addressing the problem and its components, the next step is to give answers to the issue outlining best practices and useful policy recommendations.

Keywords: Water Scarcity, Water Pollution, Water Contaminants, Children's Health, Climate Change

Introduction

On of the most basic human right is access to safe water, sanitation and hygiene, which is, also, an important need for health and well-being. Factors, such as rapid population growth, urbanization and increasing demand for water from all sectors (agriculture, industry, energy) are influencing the exacerbation of the rising water demand (UN, 2023). According to UNESCO, one in three people don't have access to drinking water (WHO, 2019) and 1.8 million deaths are caused by water pollution annually. Environmental pollution is an underrecognized threat to children's health (Suk et al., 2016).

In spite of the size of the problem, international development and global health agendas do not address it with the same value (Landrigan et al., 2019). The purpose of this policy brief is to address the issue of water scarcity and pollution to children's health, and to share and promote the best practices and recommendations from the experts.

Water Scarcity and Water Pollution

Water scarcity is a constantly growing problem and it can be defined relatively as the amount of water that can not be physically accessed easily as supply, therefore its demand for population changes, increases and/or as water supply is affected by decreasing quantity or quality (UN, n.d.).

On the other hand, water pollution is when water is contaminated by different sources, mostly polluted substances such as chemicals, trash, bacteria, and parasites, which make the water unusable for drinking, cooking, cleaning, swimming, and other activities. It is notable that pollution in any form eventually ends up in water. Pollutants from air might settle onto lakes and oceans and from land could make into an underground stream, following a river, and finally to the ocean. As a consequence, waste materials can eventually contaminate the water nearby (Last, 2007).

Why is water scarcity an issue?

On the one hand, the efficiency of water use has risen by 9% and between the years 2015 and 2022, access to safe drinking water increased from 69% to 73%. However, many countries still face problems with water stress -2.4 billion people lived in those in 2020 (UN, 2023)- and water scarcity -half of the world's population is already threatened at least one month a year (WMO, 2022). Therefore, the UN concerns that this number will quadruple unless effective actions are made to tackle these tremendous results of climate change (UN, 2023). Respectively, limiting global warming from 2°C to 1.5°C would approximately decrease by half the percentage of the world population expected to suffer from water scarcity (Douville et al. 2021).

Freshwater, essential for humans and ecosystems, is menaced by the sea-level rise, therefore the extended salinization of groundwater (Bates et al. 2008). Furthermore, food supply would suffer from water scarcity, as agriculture uses about 70% of global freshwater on average. To understand the impact of water in food supply in numbers, FAO estimates that 1kg of cereal requires 1 and 3 tonnes of water to grow, a kilogram of beef takes up to 15 tonnes and the production of daily food needs between 2.000 and 5.000 litres. In the last 30 years, there has been an enormous increase (more than 100%) of food production and by 2050 the need for food will rise up to 60% (FAO, 2017).

Why is water pollution an issue?

Clean water is not something to take for granted considering the fact that climate change is affecting the supply of water on Earth, which only 0.5% is usable and available freshwater (WMO, 2021). In the previous year, 2.2 billion people didn't have access to safely managed drinking water, 703 million people didn't have a basic water service, 3.5 billion people were living in environments that lacked safely managed sanitation and 1.5 billion of those were without basic sanitation services. Moreover, 2 billion couldn't wash their hands in a facility and 653 million didn't have a handwashing facility at all (UN, 2023).

Climate change has aroused extreme and severe weather events that impact the water supply and quality (Caretta, et al. 2022). Rising global temperatures affect the moisture of the atmosphere, resulting on the one hand in storms and heavy rains, followed by floods, which in that case remote rivers are not safe as water resources (FAO, 2017; World Bank, 2021). Since 2000 rain-generated floods have increased by 134%, with most of person and economic losses recorded in Asia (WMO, 2021). On the other hand, global warming provokes drought risk because of the intense dry spells and water evaporation (World Bank, 2021). The number and duration of droughts also increased by 29% compared with the two previous decades, with most drought-related deaths in Africa (WMO, 2021). Water quality is affected by frequent floods and droughts and it is projected to exacerbate many forms of water pollution – from sediments to pathogens and pesticides (Bates et al. 2008).

Sources of water contamination are runoff from farms, ranches, animal feeding operations (large industrial animal farms), manufacturing operations, excessive use of fertilizers, pesticides and chemicals that can impact the water quality of rivers, lakes, water and groundwater (Etzel & Balk, 2019), sewer overflows, storm water, rocks and soil that naturally have chemicals and minerals such as arsenic, radon, and uranium, cracks in water pipes or other problems in the distribution system (CDC, 2022).

Who is vulnerable to water pollution?

Among the most vulnerable population to get sick from germs and chemicals in water are infants and young children (CDC, 2022). Children consume more food and water in proportion to their body weight and thus, they are more likely to be exposed to contaminated water (Galvez & Balk, 2017). In addition, since their metabolic and organ systems are still developing, they are at risk of coming in contact with or ingesting chemicals when they are

eating, putting objects in their mouth or crawling (Paulson & Council on Environmental Health, 2011). In 2016, pollution in air, water, soil and from chemicals caused 940,000 deaths in children worldwide, two-thirds of them in children under 5 years old. Main reasons were respiratory and gastrointestinal diseases caused by polluted air and water (Landrigan et al, 2019). Every year, 297.000 children under the age of 5 years die because of diarrhea linked to inadequate handwashing. Diseases such as cholera, dysentery, hepatitis A, and typhoid are associated with poor sanitation and contaminated water, too (WHO, 2019).

People familiar to children, healthcare professionals and parents, should be informed about the possible pollutants and their effects for the purpose of protecting the health of their children. As follows, it is important to explain the most relevant water contaminants that affect children's health, which are lead, pesticides, arsenic, perchlorate and nitrates (Bantol et al., 2020), their health effects, with the intention of suggesting policy recommendations.

Water Contaminants

Lead exposure

First of all, lead exists in various sources, such as drinking water, playing with toys, jewelry, antiques or in fields with contaminated dust or soil, getting in contact with paint chips and dust from lead paint in buildings and homes built before 1978 and in some candy and candy wrappers (National Center for Environmental Health, 2022). Drinking water contaminated with lead is due to plumbing materials that contain lead corrode (in pipes, faucets, fictures). Lead absorption is associated with low levels of calcium, iron, and zinc in blood among infants aged 6 and 12 months and in adults during periods of calcium deficiency stored lead into blood is affecting both maternal and fetal blood lead levels (BLLs) (National Toxicology Program, 2012).

If the level of lead in a child's blood is at or above the CDC action level of 3.5 micrograms per deciliter, it may be due to lead exposures from a combination of sources (EPA, 2023).

EPA estimates that up 20% or more of one's total exposure to lead can be drinking water and for infants who consume mostly mixed formula, the percentage reaches 40% to 60% of their exposure to lead from drinking water (EPA, 2023). Children in school and child care settings might be exposed to lead as, unfortunately, in most facilities, lead testing in drinking water is not required by law, thereby protecting them from lead in water varies across countries (GAO, 2020). Some of the serious dangers of lead exposure are damage to the brain and nervous system, slowed growth and development, learning and behavior problems, hearing and speech problems. Additionally, even low levels of lead in the blood of children can result in behavior and learning problems (Shadbegian et al. 2019), lower IQ and hyperactivity, slowed growth, hearing problems and anemia (EPA, 2023).

Pesticides

Pesticides are reagents for protecting crops against harmful pests, insect-borne diseases in humans and increased the quality and quantity of food. However, their excessive use raised issues on affecting the environment, including water resources. Pesticides occur in soils and streambed sediment, groundwater and surface water due to agricultural activities, urban use and pesticide production factories (Syafrudin et al., 2021). 1 billion pounds of pesticides is applied annually to agricultural land, non-crop land, and urban areas throughout the United States (Water Science School, 2018). People may be exposed to pesticides from food (insecticides, herbicides, fungicides) and in some water supplies where there are still running by conventional drinking water treatment technologies (Bantol et al., 2020).

Pesticide contamination in acute ratio might lead to symptoms, such as nausea, vomiting, eye irritation,

coughing, shortness of breath (Galvez & Balk, 2017) and long-term exposure to low concentration has results in non-carcinogenic health risks (Syafrudin et al., 2021). Exposure to pesticides during pregnancy is associated with miscarriages, birth defects, such as gastroschisis (Shaw et al., 2014), urogenital and nervous systems' malformations, childhood cancer (risk of lymphomas, leukemia, bone tumor), neurobehavioral disorders (Matysiak et al., 2016), musculoskeletal development, poor cognitive function in school-aged children, lower scores on tests that require working memory, reasoning, comprehension and IQ among agricultural families (Bouchard et al., 2011).

Arsenic

Arsenic is a widely metalloid found in soils, rocks, food, water and air that can be released through natural (volcanic eruptions, groundwater) and human (mining, commercial use) processes (CDC, 2018). Exposure to inorganic arsenic could cause cancer in skin, lungs, urinary bladder, kidney and, possibly, liver. Symptoms of acute poisoning are vomiting, abdominal pain and diarrhea, followed by numbness, tingling of the extremities, muscle cramping and death, in extreme cases. Moreover, effects after a long period of time could be skin pigmentation changes, skin lesions, hard patches on the palms and soles of the feet (hyperkeratosis), and adverse health effects may be developmental effects, diabetes, pulmonary disease and cardiovascular disease. Regarding children, arsenic is associated with adverse pregnancy outcomes, infant mortality (Quansah et al., 2015), increased mortality in young adults due to multiple cancers, lung disease, heart attacks and kidney failure (Farzan et al., 2013), problems with cognitive development, intelligence and memory (Tolins et al., 2014).

Perchlorate and Nitrate

Perchlorate and nitrate are common environmental pollutants in daily life. The former appears in military operations, explosives, fireworks, and notably high in drinking water and food (Nizinski et al., 2020). The latter is used as agricultural fertilizers, preservatives in processed meats and in contaminated water and leafy vegetables (Ward et al., 2018). Consequences of exposure to perchlorate and nitrate are perturbed thyroid homeostasis by lack of iodine uptake (Pleus & Corey, 2018), reproductive problems as urinary perchlorate and nitrate levels may relate to serum total testosterone levels in specific sex-age groups (Han et al., 2023). Evidence also showed that mothers with thyroid problems due to perchlorate levels had high risk of having a child with lower IQ at 3 years old (Taylor et al., 2014).

Policy Recommendations and Conclusion

The quality and adequate quantity of water is one of the principal challenges our world face that threatens human health, limits food production, disturbing ecosystem functions and menacing economic growth. Water scarcity along with pollution of freshwater resources have a greater impact that might lead to an untreated situation. Pollution has a tremendous impact on children's health and the global burden of pediatric disease is still unknown. Also, chemical exposure and potential toxicity is underestimated. In order to understand the occurrence and association of pediatric NCDs and pollution, as well as the health effects, it is essential to invest in research to define new chemical pollutants, their characteristics and their associations to diseases (Landrigan et al. 2019).

Prevention is the key to pollution and it can be an opportunity to ameliorate children's health and prevent possible diseases (Landrigan et al. 2019).

Collectively and individually, we have the duty to diminish this problem by taking the right actions, widely known from the professionals. Some of solutions that can manage the danger from climate change are:

● Plan, implement and evaluate water management policies for healthy aquatic ecosystems aiming at lower greenhouse gas emissions and protection against climate hazards (Water and Climate Coalition).

● Nature based solutions to reduce greenhouse gas emissions and protect from extreme weather events, such as wetlands (mangroves, seagrasses, marshes, swamps) which are highly effective at absorbing and storaging of CO.2, excess water from storms and precipitation (UNEP, n.d.).

● Invest in early warning systems for floods, droughts and other water-related hazards to reduce disaster risk (30% less damage after a 24-hour warning of a coming storm) (WMO, 2022).

● Invest and use of water supply and sanitation systems (ex. filter certified to reduce chemicals, lead, reverse osmosis or anion exchange for perchlorate and nitrates treatment) and facilities that can withstand climate change (Mountford et al., 2018; Maffini et al., 2016).

● Use of climate-smart agriculture means (drip irrigation) (UNEP, n.d.).

●Invest in implementing programs for the protection and restoration of water-related ecosystems and hygiene education (EPA, 2023c)

● Regarding children's protection from chemicals' exposure, healthcare professionals (pediatricians, specialized nurses, health visitors) could play an important role in the prevention of drinking contaminant water, with regular recommendations, consultations and providing educational resources to children's parents (EPA, 2023b).

● National, local and community leaders should strengthen communication systems to improve access to information regarding water pollution and quality with civil society (Scharp et al., 2019).

● Water-service providers (public and private) could develop and manage drinking-water safety plans to meet drinking-water standards and safeguard supplies against potential risks (Scharp et al., 2019).

● Construction services should cooperate with water-service providers and public health specialists with the aim of investigation, surveillance and management of water utility services in buildings constructed before 1978, especially schools, due to high risk of lead and pesticide pollution (National Center for Environmental Health, 2022).

● Educate and engage the community members to understand the risks of chemicals, exposure, their sources (crops, cooking water) (WHO, 2022).

● High-risk populations should be monitored. Although children with lead in their blood may seem healthy and have no visible signs or symptoms, CDC recommends blood testing at the age of 12 and 24 months (CDC, 2022). Usually, skin problems might be early signs of arsenic poisoning (WHO, 2022).

●Install arsenic removal systems – either centralized or domestic – and ensure the appropriate disposal of the removed arsenic. Technologies for arsenic removal include oxidation, coagulation-precipitation, absorption, ion exchange and membrane techniques.

● Reduce occupational exposure from industrial processes.

● Independent surveillance agencies could be responsible to assess the relationships and performance of sector institutions (ex. schools) in meeting health-based targets (Scharp et al., 2019).

● Decision makers should advocate on policy and regulatory reforms regarding water quality and protection. Also, civil society should force decision makers to advocate about those matters (Scharp et al., 2019).

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Delignitisation and Fair Transition: The Case of Western Macedonia

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Abstract

Western Macedonia, historically reliant on lignite mining and lignite-based energy production, now stands at the forefront of Europe's transition to a sustainable energy landscape. This policy brief explores the challenges and opportunities inherent in the delignitisation of the region, emphasizing the importance of a fair and inclusive transition. As the demand for lignite wanes due to environmental concerns and the ascendancy of renewable energy sources, Western Macedonia faces economic, social, and environmental pressures. The brief underscores the necessity for tailored strategies that address workforce retraining, economic diversification, infrastructure development, and social cohesion. The commitment to a fair transition represents a pivotal opportunity to create a resilient, vibrant, and sustainable future for Western Macedonia.

Keywords: Delignitisation, Fair Transition, Western Macedonia, Renewable Energy Sources

Introduction

In its attempt to move towards a more sustainable future for Europe, the European Commission proposed in 2019 the European Green Deal, which came with ambitious targets to drastically cut down energy emissions in line with the ultimate objective of reaching carbon neutrality. To achieve those goals, the decarbonisation of the energy production sector is necessitated as in many regions across the EU, energy is produced through the highly-pollutant coal. As a result, one of the identified policy goals is to gradually phase out energy production through coal. The energy transition will have a major socio-economic impact on those coal regions as high levels of unemployment are predicted (World Bank, n.d.). To address those concerns, the EU has created the Just Transition Mechanism, which incorporates the Just Transition Fund, and envisages to support those regions in their energy transition plans and "leave no one behind" by granting them funding of €55 billion over the course of 2021-2027 (European Commission, n.d.).

Among the EU Member States that have long counted on coal for their energy production is Greece. More specifically, Greece has been using lignite which has permitted it to profit from a relatively cheap energy production with important impact however on public health and the environment (Heinrich Böll Stiftung, 2015). Greece makes an interesting case study to examine potential opportunities offered by the Just Transition Fund considering that the country has also been attempting to achieve its economic recovery following a decade marked by its debt crisis. The region in focus will be Western Macedonia as it is the main lignite area in the country.

Building clean energy infrastructure will create a greener, friendlier, healthier environment for citizens and tourists that visit the cities.

Additionally, tourism can play a major part in the economic development of the region with the help of the state. Ecotourism, agrotourism, wine tourism and fishing tourism are all sectors that could accelerate economic development. But regardless of the benefits decarbonization might bring, one must also consider the potential threats to economic prosperity and societal wellbeing. One of these threats would be the big increase in wind turbine and photovoltaics installation on land that is used for agriculture and livestock, with the biodiversity and the microclimate of the area being degraded.

The Case of Western Macedonia

The European Union is striving to become the first climate-neutral continent by 2050. To do this it is necessary to wean itself off energy and fuels that are harmful to the environment.One of these fuels is lignite, which for many years has been the main fuel of Greek production. Given the shift to renewable energy sources, many lignite plants will be forced to close. This is a problem for several regions and especially for Western Macedonia, where its viability rests on these factories.

Western Macedonia has been the powerhouse of Greece for over 70 years. Taking into consideration that this region was home to 80% of the lignite industry (Ziouzios et al., 2021), it is clear that decarbonisation will affect the local economy highly. Reducing lignite usage and closing down units translates to thousands of people losing their jobs, and therefore creating a risk for economic downturn and migration to other cities. However, the Ministry of Environment and Energy has proposed a Just Transition Development Plan setting the new axes for development (SDAM, 2021): Clean energy, industry and commerce, smart agricultural production, and lastly, sustainable tourism.

However, the population and employment will be directly affected. It is a fact that the majority of the opulation of western Macedonia is concentrated in the regions of Kozani and Florina. This means that a large number of workers are employed in lignite-related activities. More specifically, in 2019, 7,470 people were employed in activities related to lignite (SDAM, 2021).

The Ministry supports that these investments will absorb the workers that will be laid off due to the decarbonization efforts, plus a part of the short-term unemployed workforce in the surrounding affected areas. Moreover, ecarbonizing will give the citizens of these villages, and in general those who live near the pollutive powerhouses the chance to live in greener cities with cleaner air and fewer life-threatening health cases caused by the usage of lignite.

The Region of Western Macedonia is expected to be more affected by delignitization, as areas such as Kozani and Florina contribute to the total GDP of the Region by 80% (SDAM, 2021).It is clear that the economy of these areas depends on the production of lignite. However, the activities are not limited only there as activities such as energy and water supply are directly dependent on dealing with lignite. In addition, many businesses in Western Macedonia were active in lignite-related activities.

In conclusion, it appears that the Region of Western Macedonia is dependent on dealing with lignite. It is therefore important to investigate what the future of the area will be, after the closure of lignite production.Impacts such as regional decline and problems such as unemployment and investments raise questions about the goal of the green transition.

Policy Recommendations

The region of Western Macedonia should turn to alternatives in order to achieve a Just Transition of the area, while the Greek and local government should bear in mind the socio-economic impacts for the residents of the region.

The placement of solar panels and wind turbines in the infrastructures used as lignite power plants is

an alternative to cover the loss of energy production caused by the closure of these facilities. Solar energy intercepted by earth is 10.000 greater than the human energy consumption (UN, n.d.), but that does not mean that we are capable of capturing the aggregateof this amount of energy. In addition, wind turbines are not predicted to be efficient in Western Macedonia, since it is a region with winds that travel slower than 3 miles per hour on average. Therefore, their energy production will have a significantly small impact (Katopodis et al., 2019).

Geothermal energy is a source of energy that has been neglected by the Greek Government, but in recent years there has been an interest shown by the Ministry of Environment and Energy. Greece due to its active tectonic and volcanic activity (Karytsas et al., 2019) is a country that has rich geothermal dynamics that could benefit the attempts to achieve carbon neutralization, without burdening the environment (Ministry of Environment and Energy, n.d.)

The Hellenic Survey of Geology & Mineral Exploration has conducted a series of researches in Greece during the years 2019-2022. Greece is aiming at installing power plants of geothermal energy until 2030, while the total investment plan reaches 120 million euros (Mendrinos et al., 2022).

Local societies have been in general against the creation of geothermal power plant in their region (Karytsas et al., 2019), but according to Greenpeace, 75% of Greeks believe that the country should consider alternatives for renewable energy, following the energy crises, caused by the war in Ukraine (Greenpeace, 2022).

On the other hand, Hydropower is 8 times more efficient than solar power and 1.5 times more efficient than nuclear power (Fendt & Parsons, 2021). In addition, it has low cost of operation and long plant life and a possible turn to hydropower stations could create 15.000 to 28.000 jobs across Europe (Malesios & Arabatzis, 2010).

Some important points regarding Hydropower are that the creation of Hydropower plants must comply with the provisions of Water Framework Directive and that 65% of the country's surface water potential is located in the Western Macedonia (Farmaki et al., 2021).

Therefore, Greece could proceed with placements of Hydropower stations in the region. Globally, 10.5 GW are produced by hydroelectric facilities annually, while the total feasible hydro potential can reach up to 14000 TW (Malesios & Arabatzis, 2010). In 2019 hydropower provided 23% of all the electricity production made in the country by renewable resources. 4059 GWh were produced by hydropower stations while the total production (including non-renewable sources) was 48,742 GW (10%) (Malesios & Arabatzis, 2010). The total installed capacity in Greece for 2019 is 48,742 GWh. This is made up of coal/lignite (10,805 GWh), oil (4471 GWh), natural gas (16,303 GWh), hydroelectric power (4059 GWh), wind energy (7278 GWh), biofuels (1579 GWh), waste incineration (0.29 GWh) and solar photovoltaic (3961 GWh) (Farmaki et al., 2021)

The placement of industrial electric power parks, battery factories, and a large hydroponics unit (Farmaki et al., 2021) while at the same time the use of lignite resources in an eco-friendly manner could result in an alternation of the region, in order to achieve just transition. The cost of these actions is estimated around 5 billion euros. The funds will come from commercial loans (40%), European Sources (30%), private investment (20%) and grants (10%) (Ziouzios et al., 2021)

The extortion of Rare Earth Elements from lignite resources could support the local economy with employment positions without having negative effects on the environment. Those elements could be used in technology and could result in innovation of business activity in the region relevant to technology (Smartphones, Computers etc.). Gasification is also an option as well as the production of filters with active carbon, carbon fibers and others as well, in order to support local economic activities (Academy of Athens, 2020).

To ensure that citizens also reap the benefits of investing in renewables and to alleviate the cost of transitioning for them, it is important to support energy communities in Western Macedonia. It is a fairly new concept that puts citizens to the fore and incentivises them to develop self-sustained communities based on renewable energy (European Commission, n.d.). The number of energy communities has been on the rise the past few years in Western Macedonia (The Green Tank, 2023). It is important that the Greek national government prioritizes the further development of them in this region to offset the costs associated with decarbonisation and to make energy cheaper for its residents in the face of the energy crisis and inflation. Meanwhile, through the energy communities, political participation is also enhanced, considering that citizens are at the forefront, further strengthening local communities. One possible way to do that would be to utilize funds from the Just Transition Fund that was created within the framework of the Green New Deal by the EU.

Conclusions

The use of lignite in energy generation has caused several negative consequences of many forms in Western Macedonia. Under the framework of the Green Deal, the alternation of energy production methods constitutes an obligation that becomes an opportunity to use green energy alternatives, aiming the reduction of CO2 emissions and the minimization of the consequences in local economy. The Just Transition Fund is an opportunity for the local government and the local society to support reforms in the region, providing a safer environment, better living conditions and financial opportunities for the generations to come, while also fighting the phenomenon of migration of younger people towards other large cities of Greece. Creating working positions and promoting business initiatives will support younger generations that would like to stay and work in their birthplace. The power generation using renewable sources of energy (hydropower, solar panels, wind turbines etc.) and an establishment of energy communities could ensure energy security which is of the outmost importance for national security, create working positions for locals and offer better living conditions to the inhabitants of the region, a significant proportion of whom suffer from health problems due to CO2 emissions due to the use of lignite in power generation.

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The Impact of New Technologies in the Environment

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Abstract

The impact of technology is present in every aspect of the world, including the environment and the people. New and emerging technologies have been invented, in an attempt to solve worldwide problems such as air and water pollution. Are those technologies really making a difference or is the problem enlarging? Questions like these are answered in this policy brief, focusing on solar energy, electric vehicles trying to rule the car industry, and hydrogen technology which leads the way for a much safer and environmentally friendly future. Even though there are drawbacks to every technology, the numerous efforts for a greener environment and new inventions, beneficial to new technologies are present. In this brief, a discussion on the benefits and drawbacks of these technologies is made, and best practises and are discussed to strengthen the benefits and manage any adverse effects.

Keywords: Renewable Energy Sources, Electric Vehicles, Solar Energy, Hydrogen

Introduction

Questions like 'What makes technology what it is and makes it fit for the 21st century?' have been the major issue for researchers and policymakers nowadays, where environmental sustainability and clean production is hughly valued (Hu et al., 2022). Extensively, as stated by Edinburgh Sensors (2021), new technologies emerge with great power, transitioning to new processes, bringing technological advancements but, also, damaging the natural environment. The two considerable ways those technologies have damaged the world are pollution and depletion of natural resources. As WWF Australia (2017) notes, global developments in modern technologies are determining the way people live, with new approaches becoming necessary to solve the problem of climate change, scarce resources, urbanisation, and economic inequality. According to Irfan (2023), the United States has begun to move away from fossil fuels, having a law to deal with climate change, including $369 billion for climate priorities.

Into this policy brief are presented some of the existing problems which have been created due to the prevalence of traditional technologies worldwide, as well as the effort of new technologies and their predominance of the future, such as wind and solar energy. However, the drawbacks of those new and emerging technologies are not absent. A reference to electric cars and their attempt to dominate over traditional cars is made, as well as to hydrogen technology leading the way for a greener future.

The Impact of Technology on Air and Water Pollution

Beginning with air pollution, Song et al. (2023) stated that the percentage of the global population that breathes air that surpass WHO guideline limits

is over 99%, with the air containing high levels of pollutants. In addition, the major global public health issues are the effect of poor air quality and has a result of over 6 million premature deaths yearly. According to Health Effects Institute (2020), the pandemic of Covid-19 and the restrictions of it, led many countries around the globe to experience blue skies and starry nights, possibly for the first time in years, having however significant societal and personal costs. Moreover, the cause behind the 20% of newborn deaths globally is air pollution, and in 2019 about 500,000 deaths were counted, among infants in their first month of life, due to air pollution.

In addition to air pollution, water pollution, according to Song et al. (2023) is a crucial public health issue in many nations. The 2016 Snapshot Report of the Worlds' Water Quality stated that 1/3 of rivers is affected by a few pathogenic pollutions, 1/7 by severe organic pollution, and 1/10 of water bodies by severe and moderate salinity pollution in the regions of Latin America, Africa, and Asia. As reported by Song et al. (2023), industrialization and urbanization demote the environment due to dangerous emissions and water pollutants, challenging policymakers aiming to develop sustainability.

According to Song et al. (2023), direct benefits to the environment could bring the use of robotics, reduce material loss in manufacturing and supply chain operations, and digitalize the environmental monitoring. As mentioned in the same research, industrial robots could improve labour productivity and efficiency of energy, leading to new inventions of cleaner production technologies. In addition to this, as BBC (n.d.) states, energy costs have been cut down by using more efficient products such as low-energy light bulbs. Noted on the same article, is the global awareness that limits the levels of pollution and emissions of greenhouse gases, attempting to solve global warming and targeting renewable energy.

Drawbacks are not absent, as reported by Ledger (2020), since 4% of greenhouse gas emissions are the result of digital technologies, expecting to double by 2025, with energy demands increasing by 8% a year. As Edinburgh Sensors (2021) states, air pollution relates to the industrial revolution, which brought emerging technologies such as burning of fossil fuels, factories, power stations, mass agriculture and vehicles. In addition to the same research, the consequences of air pollution contain negative impacts on health for humans and animals, and global warming causing Earth's temperature to rise dramatically. Concerning water pollution, common water pollutants include domestic waste, industrial sewage, insecticide, and pesticides, which all could lead to diseases, devastation of ecosystems and negatively affect the food chain.

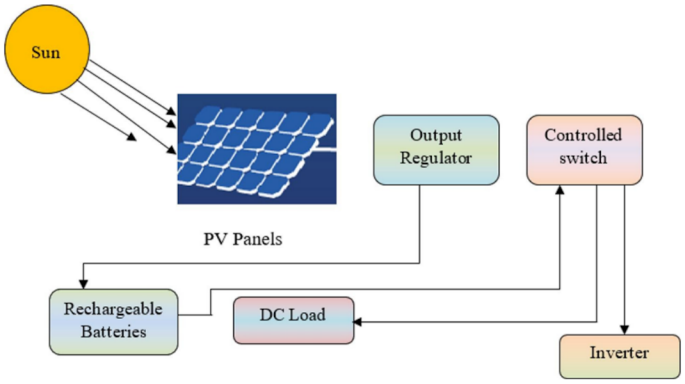
Wind and Solar Energy

According to Summerfield-Ryan and Park (2023), wind energy has grown to a cost-competitive worldwide energy source, declining by 22% since 2010 with further declines predicted. Furthermore, Chaurasiya et al. (2023) state that wind energy has been a widely accessible energy-source globally gaining enormous interest, and in the future could prosperously be a substitute for traditional energy sources, accounting a sizable percentage of global energy demands. Moreover, Draxl et al. (2021) declare the mapping of a scenario for wind energy to supply 35% of the United States' electricity demands by 2050 created by the US Department of Energy's Wind Vision. Added to this, plans of wind energy on complex terrain are not stopping and will be continued for the satisfaction of that portfolio.

Concerning solar energy, Hussain et al. (2023) highlight that 1% increase in wind and solar energy could reduce the ecological footprint by 3.1%, adding solar energy to a path of being more attached to electricity purposes. In the same research it is said that wind and solar energy have a restricted

production since non-renewable energy resources dominate. Despite the dominance of those non-renewable energy resources, the demand for low-carbon energy resources, such as solar energy, has increased worldwide. To add to this view, Algarni et al. (2023) notes that solar energy units do not produce harmful emissions while in use, unlike controversial power plants, with safety to arise during production, installation, and disposal.

Figure 1: Renewable Energy Sources



Source: Algarni et al. (2023)

According to Algarni et al. (2023), renewable energy sources are possible to contribute to economy, society, and environmental energy sustainability, providing energy worldwide, reducing emissions of pollutants and bringing opportunities for local socioeconomic development. Moreover, Edinburgh Sensors (2021) reported that renewable energy technologies such as wind turbines and solar panels are becoming cheaper, letting governments invest more, raising the installations of solar panels on rooftops in Australia from around 4.600 households to over 1.6 million, from 2007 to 2017. As Igini (2022) states, solar energy is a renewable energy source, plentiful, getting more efficient and cheaper and the life cycle of it leaves minimal greenhouse gas emissions.

Disadvantages are present, conforming to Algarni et al. (2023) who stated that power from renewable energy sources, without including hydropower, comes with more damage to the environment, and a lack of natural resources to be available per kilowatt-hour than traditional sources of energy. Also, according to Igini (2022), solar energy depends on weather, is costly for households, and solar power plants are not the best environmentally friendly choice.

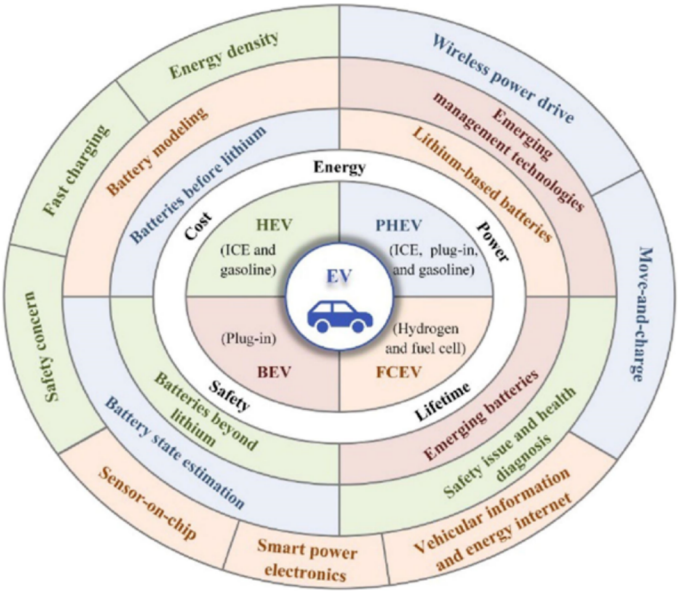
Electric Vehicles

The evolution of vehicles is being developed constantly, leading electric vehicles to be the future of transportation. More analytically, Das et al. (2023) mention that numerous electric vehicles (EVs) have been and being developed globally with the four types being hybrid electric cars (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel cell electric vehicles (FCEVs), and fully battery electric vehicles (BEVs). Furthermore, some of the benefits of accepting electric vehicles are reduced fuel dependency and reduced emissions, miniature carbon footprint aiming toward carbon neutrality, preventing global warming, with a start of sustainable transport revolution. According to Edinburgh Sensors (2021), tax credits and inducements from governments have been used to encourage plug-in vehicles and to introduce the adoption of electric vehicles. As noted by IEA (2021), the number of electric vehicles that are on the road globally will reach ten million in 2020, expanding the availability of them, despite having Covid-19 as a barrier. The sales of EVs were estimated to be 4.6% of the total car sales worldwide, in 2020, with them gaining a notable number of support policies since then. The decade of 2020, according to the International Energy Agency (IEA, 2021), will mark the transition to EVs, requiring more action by both consumers and producers than the previous decade of 2010s, broadening the development and the use of them in the market.

According to Das et al. (2023), larger measures are required for speeding up charging and improving battery performance, with the leading disadvantage being the restricted mobility of electric vehicles. According to Lakshami (2023), mining the

materials a battery requires for it to be built, has a high environmental cost, making the electric vehicle manufacturing procedure more demanding in energy than an internal combustion engine vehicle. In the same article it is said that the impact on the environment comes from the toxic fumes released in the mining procedure and the water-intensive nature of this process. Heilweil (2022) states that it can be determined that lithium mining is not environmentally friendly, even though lithium mines are limited in their number, and in addition, other metals like cobalt are extracted in the Democratic Republic of Congo, which is linked with child labour. To sum up with electric vehicles, Li et al. (2022) emphasize the dramatic degradation of lithium-ion batteries at low temperatures, making EVs more untenable, until the difficulties are solved.

Figure 2: EVs, Various Battery Types and their benefits



Source: Das et al. (2023)

Hydrogen Technology

Dermühl and Riedel (2023) note that for a transition of clean energy to be accomplished, large amounts of low-carbon hydrogen and increasing share of renewable electricity is obligatory. Additionally, to have a decarbonized system there is a need for enormous amounts of climate neutral hydrogen, produced as efficiently and cost-effective as possible, since there is no fear of direct CO2 emissions.

Actions such as the European Green Deal, and studies like the IEA's "World Energy Outlook 2021" both highlight the importance of hydrogen and the essentiality of this technology for a greenhouse-gas-neutral energy future, with hydrogen storing the increasing share of renewable electricity over long periods, having the energy transportable and ready to use.

The benefits of hydrogen energy are noticeable with it being non-toxic, compared to other sources of energy like gas and coal (Rinkesh, 2013). In addition, hydrogen energy is capable of launching spaceships for exploration missions to space, having simultaneously a sustainable production system. Its production is made possible through the separation of water into hydrogen and oxygen called electrolysis, in which electrolysers powered by renewable energy sources can be used for the system. After the separation, the separated hydrogen is used in a fuel cell to produce electricity, having non toxic waste.

Disadvantages are present even in hydrogen technology, with the production and storage of it being detrimental (Koons, 2023). The cost of producing and storing hydrogen is the direct effect of electrolysis, which is expensive to create and, also, energy demanding, with it having difficult conditions to store as hydrogen is a gas at room temperature. Furthermore, the lack of infrastructure makes the process even more complicated with the U.S. The Department of Energy reports only 48 hydrogen fuelling stations in the United States by the middle of 2021. Alongside those cons, the density of hydrogen is three times greater than gasoline when converted into a liquid from gas, with the ratio becoming from 1L of hydrogen to one-fourth of gasoline, to much greater than it, adding on some financial concerns.

Policy Recommendations

Renewable Energy Sources

As Energy5 (2023a) notes, a significant policy that is associated with solar energy is the solar investment tax credit (ITC), in which homeowners and businesses who have installed solar panels, and invested in solar energy, could receive a tax credit up to 26% of the total cost. ITC, first introduced in 2006, fosters the adoption of solar energy, making solar systems more affordable and obtainable. In addition by the same source, inducements such as tax credits, discounts, or grants are what governments have been carrying out to promote the use of renewable energy sources. Some strategies and action plans for renewable energy sources include identifying the obstacles and surmount them and involve national and local authorities. A good example of those policies, as stated by IEA (2018), are Denmark's deep-seated approach to energy planning, which includes regional and local authorities. Moreover, data should be freely available to the public about renewable energy sources, and they should be developed for each renewable technology, and the costs of them, with the Kazakhstan wind atlas being a great example of this policy, notes the International Energy Agency (2018).

Electric Vehicles

Government's role, as Energy5 (2023b) notes, is important in fostering EVs and their batteries with specific policies such as battery recycling programs, supporting the recycling and reuse of EVs batteries, with the EU to require for car manufactures to accumulate at least 50% of produced batteries and recycle them. In addition to this, financial motivation should be a part of the policies, encouraging the citizens to acquire an electric car, as UK has done with a plug-in car grant, reducing the final cost of the purchase of the EV. Moreover, awareness actions and education are significant policies, that governments should be attentive, educating the public and the importance of EV's battery management, as so as the disposal of them correctly (Energy5, 2023b).

The World Economic Forum (2023) highlights that along with recycling EV's batteries, the cost of the process will have to be reduced. This reduction could be made possible with the use of robotics and automations, in addition with battery passports which inform for the type, health and charge of the battery.

Hydrogen Energy Policies

According to the Internatioanl Energy Agency (2023), infrastructure is needed for the transportation of hydrogen technology, which today is mostly produced and consumed in the same location. Adding from the same source, with the incremental demand for hydrogen pipelines are becoming the most efficient and inexpensive way for the transportation of it. An example of government investing in this technology is in the Netherlands, which in June 2022 invested EUR 750 million for the elaboration of a national hydrogen transmission network. Furthermore, the European Hydrogen Backbone (EHB, n.d.) was established to create a pan-European hydrogen infrastructure, with 32 energy infrastructure operators. Under development is, also, infrastructure for hydrogen storage, such as Hypster (Hydrogen Pilot Storage for large Ecosystem Replication) in France, which was officially launched in January 2021 (HYPSTER Project, n.d.). The International Energy Agency (2023) notes that at the end of 2022, 32 governments had a strategy ready for hydrogen. Some of those governments have already implemented grants, loans, and tax breaks. United States announced a new tax credit, an investment credit and grant funding for projects specialized in hydrogen production, in addition to the Department of Energy opening a 7 billion dollars call for regional clean hydrogen hubs in September 2022.

Conclusions

In conclusion, the rapid development and adoption of technologies such as electric vehicles (EVs), renewable energy sources, and hydrogen hold immense promise for addressing critical environmental and energy challenges. These innovations offer numerous advantages, including reduced greenhouse gas emissions, improved air quality, and energy security. They are pivotal in our transition toward a more sustainable and resilient future.

To harness the full potential of these technologies, comprehensive policies are essential. Governments must prioritize investments in infrastructure, incentivize research and development, and establish regulatory frameworks that encourage innovation and sustainability. Additionally, public awareness and education initiatives are crucial to ensure a smooth transition.

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ChatGPT in Higher Education: A Wind of Change Blowing in Various Directions

Elena Soroliou, Maria-Odile Kritikou, Anna Kania, Sotiris Antonopoulos

Abstract

While within the last months several studies reveal the real and full implementations of the cutting edge ChatGPT in higher education institutions, a comprehensive examination of its potential at the micro and macro levels of higher education is crucial. To address this gap, this policy brief scrutinises the integrated and potential capabilities of ChatGPT through three lens-levels: student-facing, teacher-facing, and system-facing capabilities, disadvantages, blind spots, challenges and risks. The core aim of this policy brief is to research and shed light on a robust and nuanced understanding of the level of (in)appropriateness of ChatGPT's use in higher education among core stakeholders, i.e. educators, students, and administrators, who co-sign an "educational contract" via core emerging trends and implications. Finally, a set of applicable recommendations is presented for policy makers, other interlocutors, and future researchers, in order to walk the talk for the more ethical, inclusive and equitable use of AI in higher education, since a "one-size fits all" approach should be strongly avoided.

Keywords: Artificial Intelligence, Higher Education, ChatGPT, Students, Academics

Introduction

ChatGPT - which stands for a real Artificial Intelligence ("AI") sensation (Gilbard, 2023) and "generative pretrained transformer" - has been characterised as the scientific and technological breakthrough of the decade (Llaners, 2023) [1]. Five days after its official launch, more than 1.000.000 people had signed up to use it (Buchholz, 2023), while it reached 100 million users two months later (Milmo, 2023). ChatGPT's thousands of supporters thrive on its capabilities in astonished and grandiose terms, especially due to its speediness, technical ascendance/predominance and interesting combinations of information (Roose, 2022).

Unavoidably, ChatGPT could be characterised as "smarter", weirder, more flexible and interactive in comparison with other Natural Language Processing ("NLP") previously used technological models and flattering chatbots [2]. In detail, chatGPT also seems to be ominously good at answering the types of open-ended analytical questions, frequently appearing on higher education assignments. Due to these reasons, plenty of educators have predicted that versatile ChatGPT, and similar tools, will spell the end of homework and take-home exams (Roose, 2022).

This policy brief mainly focuses on ChatGPT's

[1] According to the United Nations Educational Scientific and Cultural Organization (2023, p. 5) "*ChatGPT is a language model that allows people to interact with a computer in a more natural and conversational way. ChatGPT uses natural language processing to learn from Internet data, providing users with artificial intelligence-based written answers to questions or prompts*".
[2] According to IBM (2023) "*Natural Language Processing ("NLP") refers to the branch of computer science -and more specifically, the branch of Artificial Intelligence or AI - concerned with giving computers the ability to understand text and spoken words in much the same way human beings can*".

most important advantages and disadvantages, challenges and risks for the signees and signers of the educational contract in and for the academia, i.e educational and administration staff, and students. The subject is approached via three levels-lenses: the teacher-facing, the student-facing and the system-facing tools and characteristics, while exploring ChatGPT's core advantages and disadvantages. Additionally, the policy brief aims to: a) underline the access to ChatGPT's functionality; b) shed wider light to its designers' and users' proactivity and foresight, and c) highlight that its use by people will show that it can be a double-edged sword. Finally, the authors suggest a set of policies, in order to establish and maintain a fairer and more detectable mandate with the AI enterprises and other organisations.

Advantages of ChatGPT in Higher Education

According to Wingard (2023), Universities should have a holistic view and thoroughly tweak and adapt their curricula at least every single year. Therefore, this implementation and wise use of AI technologies in higher education will become and appear as a necessity in the near future, in order for universities to provide their students with competitive degrees for the globalised market. Stalzer (2023) underlines the dominance of the technological titans, such as Google, Microsoft, Apple, and Amazon and their neural networks of course, but most importantly their capabilities for deeper and stronger interconnectivity and interoperability of different types of databases and information.

According to Metzler and ChatGPT (2022), Stalzer (2023), and Stock (2023), who focus on the main advantages of the ChatGPT's applications, students -but also teachers- can write entire essays or articles based on a well-stated prompt, generate new content and do desk research, prepare a press release, compose a story or play, write basic code, create or upgrade basic material for social media, excel or better connect their research questions and translate or summarise texts. Simply put, students could wisely use ChatGPT, in order to save time from mechanistic tasks and devote their energy for more complex scopes and frameworks (Heaven, 2023).

From the student and teacher facing levels-lenses, apart from the previously mentioned capabilities, students can use ChatGPT as a more interactive and faster than "turbocharged" Google search engine, since it rapidly combines information and knowledge (O'Byrne, 2023; Roose, 2022, UNESCO, 2023). Additionally, both students and academics could be benefited by ChatGPT's use via real-time feedback, which is a daunting task especially for academics in classes of 20 or even more students, taking into consideration that everyone is comprehending, learning and consolidating information via different ways. From this point of view a personalised and adjustable learning system could be optimised and supported. Therefore, this could be adopted and applied in higher education institutions in Greece, where it seems as the main rule and trend. Following Varwandkar's (2023) point in a different contextualisation in India, students could have a digital tutor, who would help them understand difficult conceptualisations and provide them with additional motivations to deal with the academic liabilities.

Both students and academics could be also benefited by "intelligent textbooks", such as "Inquire", an iPad app that monitors students' focus and attention while reading and mainly how do they select to interact with the application, analyse their weaknesses and take measures for their support (O'Byrne, 2023). Simply put, characteristic examples of interactive text could be definitions of keywords for the deeper comprehension of the context. Furthermore, a deeper implementation could also be the suggestion of questions for future research and the inclusion of audio-visual content, i.e. videos, photos, podcasts, etc. (O'Byrne, 2023).

Furthermore, according to Gilbard (2023), academics could involve the chatGPT's use for the better organisation and planning of their courses, and in some disciplines and frameworks for their students' evaluation schemata, such as assignments. Students struggling with grammar or spelling in their or other language(s) could be unavoidably benefited and practise their capabilities more systematically (Entrepreneur Staff, 2023).

Disadvantages and Concerns for ChatGPT in Higher Education

Despite many enthusiastic views on ChatGPT, one cannot forget its serious weaknesses. For instance, the disadvantages of ChatGPT include the wide use of cheating among the students' community in higher education institutions. Gilbard (2023) crucially underlines the vacua and loopholes for dishonest behaviour, where students simply copy-paste material generated by ChatGPT and present it as their own. Undoubtedly, this core challenge endangers both ethics and effectiveness in education. According to a recent survey in Technews (2023), 51% percent of students consider using AI tools such as ChatGPT to complete assignments and exams, and this is conceptualised as a form of cheating and misuse. Gilbard (2023) supports that this situation will promote and enhance multiple inequalities, and probably lead to misleading or delusive evaluation of each student's knowledge, comprehension, "interactivity" and accreditation.

Tajik and Tajik (2023) strongly underline that inaccurate information, biased content, plagiarism, and limited or low quality's context are some of the crucial perplexing issues that occur systematically, its questionable accuracy, which is quasi-scientific, mainly based on the level of prompts' quality, as well as the fact that it is only internet-sourced is a core disadvantage for both students and academics (Lukeš, 2023 and Lukeš, 2023). More specifically, several times ChatGPT abounds in false or manipulated facts, can misunderstand context and produce bias-prone text, and undermines the plausibility and traceability of the retrieved data (Entrepreneur Staff, 2023).

Simultaneously, the authors highlight that ChatGPT cannot think critically and "understand" the deeper connotations among different frameworks or disciplines. These drawbacks can and should be also analysed from at least a European governmental system-facing level, since the above-mentioned negative impact will have far-reaching malign consequences on all the aspects of students' and academics' perspectives (European Commission, 2021). Apart from these parameters, ChatGPT's improvident use may strengthen students and academics' dependence on technology and heavy reliance on the tool (Entrepreneur Staff, 2023). If students or even academics and researchers mainly or strictly/solely rely on responses generated by AI, their creativity, originality, innovation, spirituality, coherence and problem-solving skills would be decreased (Entrepreneur Staff, 2023; Varwandkar, 2023).

From an academic-facing level, there are many looming challenges, which make some authorities even ban the software totally from use in Universities. For instance, the New York City Department of Education decided to ban ChatGPT's possible (inappropriate) applications (Gilbard, 2023). However, this doesn't seem to solve the problem, as students still use it for this scope. According to Ellen B. Meier, Professor of Computing and Educational Practice (in Gilbard, 2023), it would be wiser to redefine AI's contribution to higher education and enrich the academic repository of pedagogical tools. Similar to this point is Lalitha Vasudevan's point, Vice Dean for Digital Innovation at Columbia University (in Gilbard, 2023), according to which students and academics should become equal partners on deciding how they should use AI tools at the Universities.

Similarly, researchers pointed out AI's inclination to generate texts including racist as well as manipulated and deep-fake content, or endangering some of the currently human-pursued occupations through automation (Gilbard, 2023). Additionally, authors excelling Stock's point (2023) believe that an undisputable challenge is the need for focusing from the final result to the whole process and the crystal-clear presentation of the sources which have been used or reused for the "education" and better responses of ChatGPT.For all the aforementioned reasons, the authors strongly support that ChatGPT, as well as other AI tools, ought to be regulated by the law. For instance, drafts of regulations on AI can be found by the European Commission regarding the draft EU AI Act (2021) and its Digital Strategy attempts of which have already been taken by the European Union, the United States' or China's Government. However, the European companies sound alarm over the draft AI law, claiming disproportionate compliance costs and liability risks (Espinoza, 2023).

Risks, Plausible Costs and Red Flags

Following the main logical backbone emphasis will be put on the categorisation of risks with the extended and unregulated use of chatGPT in higher education. The authors would like to underline that if not proper attention is given to consider the challenges and limit the risks, then probably these will "reappear" in the near future as red flags and subsequently as multiple and important costs.

The complexity of the issue, affecting all the signees and signers of the educational contract, does not definitely require system-based actions. Looking at it via system-facing lenses, authorities have started to recognise the need for proper regulation of AI's use and implications, which has already been done by e.g. the EU. In accordance with The European Commission's Regulatory Framework on Artificial Intelligence there are four (4) graded levels of risk in AI, whose identification is of great use for system-created measures:

- *Unacceptable risk* (a clear threat to our safety which entails AI's total ban),
- *High risk* (AI referring to critical infrastructures that could jeopardise citizens' lives),
- *Limited risk* (users should be fully that they interact with an AI machine), and
- *Minimal or no risk* (relating to AI-enabled video games or spam filters) (European Commission, 2021).

As suggested by various researchers (Rainee & Anderson et al., 2017 & Stazler, 2023), the potential of Open AI's chatbot, still not fully recognised, imposes on its creators the necessity of algorithm transparency, ethics and awareness of its possible societal impacts. The tool ought to be controlled by both AI owners and its consumers. In the same spirit, Assistant Professor Alexandra Mihai fully agrees with the argument of Tajik & Tajik et al. (2023), that in order to fully comprehend the possible AI applications, the first and foremost milestone is for the algorithm literacy to be (deeper) included in basic education (McGraw Hill, 2023) [3]. Moreover, she underlines the necessity ofacademics and students working together with ChatGPT, in order to shed light on what actually benefits the University and what should be excluded.

From an academic-facing lens, concerns and costs should mainly focus on the reliance of chatGPT in the evaluation of educational or vocational training, which may strongly affect a person's professional

[3] Provocatively, if someone asks ChatGPT about itself and consider a comprehensive examination of the potential application of ChatGPT in Higher Education Institutions, it will refer: "*To avoid ChatGPT being used for cheating, there are a few different steps that educators and institutions could take. For example, the right education about the ethical usage of ChatGPT could be provided to students and educators when it comes to academic settings. There's also a need for guideline development and policy making for the use of ChatGPT in academic work, and to make sure that students and educators are aware of and follow these guidelines. Moreover, the use of ChatGPT in academic settings is suggested to be monitored so cheating or other unethical behaviour can be avoided. The use of ChatGPT is going to help support learning and academic achievement, rather than as a replacement for traditional forms of assessment. Incorporate critical thinking and ethical reasoning into the curriculum, to help students develop the skills and habits necessary to use AI technology responsibly*" (Tajik & Tajik, 2023).

career (Gilbard, 2023). Of course, the same applies also for the examination of students and their accreditation and progress in academia and consequently in the job market. Another plausible concern and risk is the endangerment of some currently human-pursued occupations, since technology vividly gains ground. A characteristic example is educating programmers, coding IT Specialists and secretaries. Hence, again, authors highlight the European Commission's effort via EU AI Act to lawfully regulate this AI software and all the possible hazards associated with it, in order to support teachers in real terms.

However, a concrete challenge and concern regarding the system and administration is the high level of the main game changers, such as Microsoft and Google unpredictability in combination with the low reflex actions of the global, European and the national legislation.

Moving forward to a more administrational level, authors would like to be differentiated in the debate on the topic between the "original" developer and "downstream" developer. The latter may not always be a part of the original model development but can only adjust it and incorporate its outputs into a different software. In consequence, neither of them hold complete control or a comprehensive view into the entire system. Therefore, a crucial concern is that the function of the final AI software could be difficult to be identified and furthermore, may result in its unexpected occurrence of errors (Engler, 2023).

Among others the European Union via its framework for regulation in AI applications (2021) will hopefully settle clear requirements for AI systems for high risk applications and determine certain obligations for AI users alongside providers of high risk AI tools. Furthermore, the EU framework will plausibly put forward a conformity assessment preceding the launch of a particular AI system and propose a governance structure at European and national levels. The proposed framework is aimed at the monitoring of the accuracy and clarity of the information provided by AI software as well as human-generated supervision in order to lessen the possible risks (European Commission, 2021).

There is a clear red flag that ChatGPT may diminish students' potential and ability of critical thinking due to their heavy dependence on it and lack of creative approach towards its use (Gilbard, 2023). An essential factor in increasing students' self-dependence when creating thoughts, accompanied by AI tools, is teachers. As pointed out by experts, education professionals need to first get themselves familiarised with proper incorporation of the software into teaching, classroom management and the design of lesson planning. Only then they can and may fully use AI tools for the benefits of their learners, thus taking care of students' capability of critical thinking (Gilbard, 2023).

Furthermore, excelling National CyberSecurity Center's argumentation (NCSC, 2023) as serious concerns and red flags could be also conceptualised the coaching of users in harmful behaviours and tactics, which aim to their manipulation. The ubiquitous character of technology in the framework of higher education for both academics and students, in order to combinedly promote and encourage ChatGPT's safe use, is a difficult challenge for all and a daily and daunting task, which should be prioritised. Then, NCSC underlines that we should not isolate the human factor from ChatGPT, since until now its content is not totally accurate, trustworthy, concrete and regulated. Another challenge for academics is to deeper probe its capabilities and explore its limitations. Otherwise, some clear and predictable signs and signals of red flags are the misleading information or even worse disinformation and the hallucination of incorrect, imaginary or unreal facts, biased information and content, increase of gullible users, need for huge compute resources and vast datasets for the training of chatbots via shady LLM models and suspicious techniques.

Another red flag in these LLM models can be

coaxed into creating toxic content and AI chatbots are prone to "injection attacks" (NCSC, 2023). Therefore, some undoubted and high risks are the limited data security, continued data breaches, the ethical concerns for the fairness of using AI in modern education, some jobs displacement and staff redundancies, the creation of malware, and the over-dependence of people from technocracy.

Is it time to move fast and break things (Zuckerberg) or time to hit pause (Musk)?

Traditional higher education used to be based on tacit trust, understood by reciprocal cooperation between students and academics. Since, the drastic change in the field of education forced by AI technology can not only affect the students themselves, but academics and administrators by saving them a lot of useful time through robust systematic procedures. In theory, an AI tool like ChatGPT could be even referred to as a digital personal encyclopaedia, helping all parties involved to stay on top of their most important responsibilities through a personalised experience (Tajik & Tajik, 2023).

Due to the high impact of ChatGPT in higher education, it is assumed that the employment of AI tools, as presented by Paulo Blikstein, Associate Professor of Communications, Media and Learning Technologies Design at Columbia University (Gilbard, 2023), may complicate the case and contribute to the creation of some awkward learning settings underlined by suspicion on either side (e.g. due to students' possible cheating). Moreover, creating a toxic environment, harmful to any user.

Following that argument, there seem to appear various and important question marks of mostly negative aspects regarding the limited knowledge of potential outcomes of newly designed AI models by the designers themselves as well as regarding ethics, literacy, transparency and oversight. As noted by the Hall of Fame member, technologist and founder and CTO of US Ignite, Glenn Ricart, "*The danger is that algorithms appear as 'black boxes' whose author have already decided upon the balance of positive and negative impacts – or perhaps have not even thought through all the possible negative impacts*" (in Rainie & Anderson, 2017). When talking about ethics in this specific subject one can make out two different paths, the ethics of the maker and the morals of the user. Meaning that both parties ought to use this type of technology as indicated by the regulation book of every workspace either in the digital world or the real world. Both these worlds can possibly co-exist under good conditions if the results are thought regarding the social impact they'll have as a basic principle. Therefore, the foundations of learning and teaching assisted by AI should be revised and based on ethical and fully transparent and concrete agreements among the signers and the signees of the education contract.

Aside from ChatGPT's inherent limitations, such as its inability to reason about the physical and social world, temporal reasoning, factual errors, bias and discrimination, transparency, reliability, robustness and security, and plagiarism, it cannot be denied that ChatGPT and other LLM tools, are from another aspect positively revolutionising the infrastructure of education, leading to a more efficient and effective education system that benefits all stakeholders involved. Therefore, while it is important to acknowledge and address the limitations of ChatGPT and other LLMs tools, their potential for positive impact on education cannot be ignored.

Nevertheless, several tech-companies, including "Open AI" - the company founded by Elon Musk, Sam Altman, Peter Thiel, OpenAI chief scientist Ilya Sutskever, Jessica Livingston, and Linkedin co-founder Reid Hoffman which originally landed ChatGPT (Marr, 2023), have already presented applications (e.g. GPTZero, Turnitin plagiarism detector) which have the ability to detect the use of ChatGPT or AI content in general, as they would for plagiarism. Meaning that even at a rapid technological race solutions have now risen deflecting one of the most talked about problems, the cheating factor.

In addition to the above, proposed regulations have also emerged from the EU. In accordance with the European Commission Regulatory Framework on Artificial Intelligence the interest results in monitoring of the accuracy and clarity of the information provided by AI software as well as human-generated supervision in order to lessen the possible risks (European Commission, 2021). But, in any case, it is of critical importance that all parties involved are informed and also trained as needed in use of AI tools, in order to be able to gain all potential benefits of this additional form of higher education.

Policy Recommendations and Conclusion

Provided the aforementioned argumentation and articulation the central aim of this policy brief was to gain a better understanding of the appropriateness, blind spots and red flags of ChatGPT in higher education for the anthropogeography of academics and researchers, students and administration staff. This section offers guidance for policy-makers on how best to leverage the emerging/nascent opportunities and highlight the risks, presented by the growing connection between AI and higher education.

According to the "Policymaking in the Pause" and the Future of Life Institute (2023) authors would like to adopt and further ameliorate the main policy fingers, in order to establish and maintain a fairer and more detectable mandate with the AI enterprises, other organisations, such as higher education institutions and different communities and the previously alluded anthropogeography.

1. Regulate access to computational power

The involvement of private entities, such OpenAI in higher education is not new and calls for care and regulation if selecting AI and other tools that are run by companies dependent on making profit, may not be open source (and therefore more equitable and available). Therefore, there are loopholes, according to which they may extract data for commercial purposes (Sullivan, Kelly et al., 2023).

2. Mandate robust and systematic third-party auditing and certification

According to UNESCO (2023), regardless of whether ChatGPT and other forms of AI are already being used in higher education institutions, conducting an AI audit is an important step that will help the monitoring and assessment of the current situation and support institutional planning. It is suggested that this audit is undertaken by the higher education institutions governing bodies following extensive consultation with all academic, research, administrative and IT departments, as well as with students. This triangle process should have: "Understand-Decide-Monitor" intertwined steps.

3.Establish capable AI agencies at a national, european and global level

Authors recommend that national AI agencies should be established in line with a blueprint developed by Anton Korinek at Brookings. Korinek (in the Future of Life Institute, 2023) proposes that an AI agency have the power to:

- Systematically monitor the public developments in AI progress and define a threshold for which types of advanced AI systems fall under the regulatory oversight of each agency.
- Mandate impact assessments of AI systems on various stakeholders, define specific reporting requirements for advanced AI companies and audit the impact on people's rightsat a macro-level.
- Establish enforcement authority to act upon risks identified in impact assessments and to prevent abuse of AI systems.

However, a crucial question that turns out here is who will guard the guardians? (Rainee & Anderson, 2017). The authors highlight this point given that if information is power, then logically information control is supreme power.

4. Expand the technical AI safety research funding

Exploring the Future of Life Institute (2023) logic and to ensure that AI's enterprises and other organisations capacity to control AI systems keeps pace with the growing risk that they pose, authors highly recommend a significant increase in public funding for technical AI safety research in the following research domains:

Alignment: development of technical mechanisms for ensuring AI systems learn and perform in accordance with intended expectations, intentions, and values.

Robustness and assurance: design features to ensure that AI systems responsible for critical functions can perform reliably in unexpected circumstances, and that their performance can be evaluated by their operators.

Explainability and interpretability: develop mechanisms for opaque models to report the internal logic used to produce output or make decisions in understandable ways. More explainable and interpretable AI systems facilitate better evaluations of whether output can be more credible and reliable.

The authors highly recommend increased funding for research techniques, and development of standards, for digital content provenance. Therefore, there should be criteria and standards to ensure that a reasonable person will determine whether content published online is of synthetic or natural origin, and whether the content has been digitally modified, in a manner that protects the privacy and expressive rights of its creator.

5. Develop high(er) standards for identifying and managing AI-generated content and recommendations

Due to this reason, the publication of generalised lessons should be prioritised from the impact assessments such that consumers, workers and other AI developers know what problems to look out for. This transparency would also allow academics and researchers to study trends and propose solutions to common problems. According to Dr. Chris Kubiak, Associate Head of School at the Open University, the update of plagiarism policy would be useful, in order to track and trace which students use chatGPT to fulfil their assignments (McGraw Hill, 2023).

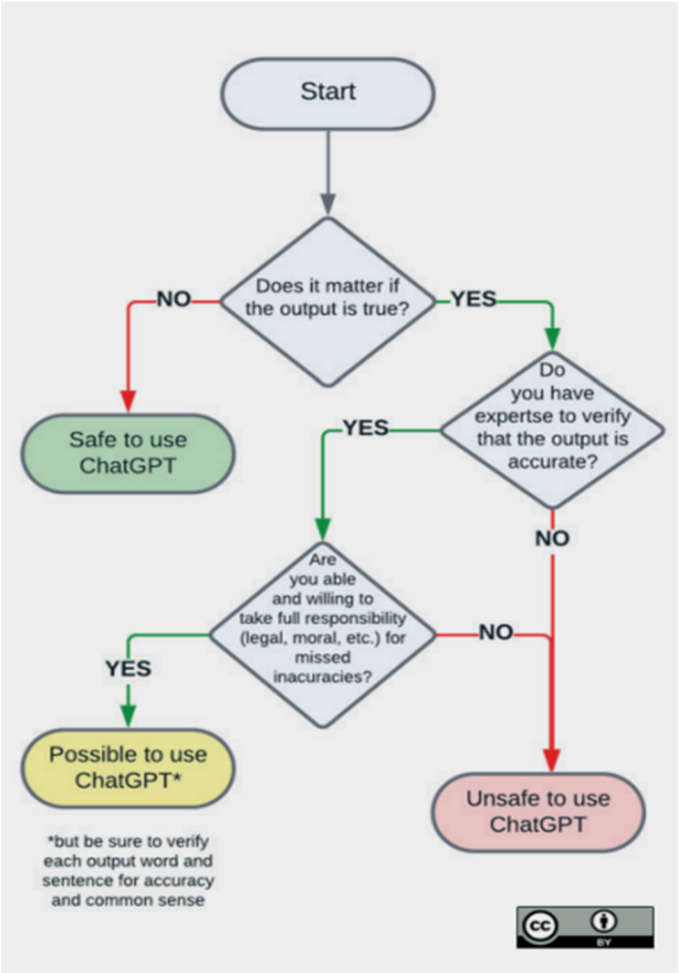
6. Establishment of laws and standards clarifying the fulfilment of "duty of loyalty" and "duty of care" when AI is used in the place of or in assistance to a human fiduciary

Authors also recommend the expansion of "bot-or-not" laws that require disclosure when a person is interacting with a chatbot. These laws help prevent users from being deceived or manipulated by AI systems impersonating humans, and facilitate contextualising the source of the information. The draft EU AI Act (2021 and 2023) requires that AI systems be designed such that users are informed they are interacting with an AI system. Almost all of the world's nations, through the adoption of a UNESCO's recommendation on the ethics of AI (2021), have recognised "*the right of users to easily identify whether they are interacting with a living being, or with an AI system imitating human characteristics*". Figure 1 can roughly depict in which cases ChatGPT would be a good choice.

ChatGPT seems to have the power to transform higher education by all the means previously alluded to. The key question -that cannot be answered yet- is if this "wind of change" will mainly have a positive, neutral or negative burden and sign. It is important to note that ChatGPT is not governed by ethical principles and cannot distinguish between right and wrong, true and false. This tool only collects information from the databases and texts it processes on the internet, so it also learns any cognitive bias and inaccuracies found in that information. It is, therefore, crucial to critically analyse the results that ChatGPT provides and compare them with other sources of information.

Technology is moving so fast and the potential risks are, in some cases, so poorly understood that there is little agreement yet on a regulatory agenda.

Figure 1: When is it safe to use ChatGPT?



Source: Tiulkanov (2023)

Undoubtedly, policies and guidelines are necessary to safeguard AI, ensuring its benefits and trustworthiness while mitigating its risks. The authors reach the consensus that only when multiple and solid checks and balances are in place, can there be a more thoughtful, beneficial expansion of generative AI technologies not only in higher education, but also in other fields of a society. Similarly, the authors maintain that powerful AI systems, such as NLP models should be developed only once scientists are confident that their effects will be positive and their risks are manageable.

Probably, a stepping back from the dangerous race to ever-larger unpredictable black-box models with emergent capabilities would be the golden ratio at this phase and until there is adequate documentation by OpenAI for the internal mechanisms of ChatGPT. In the meantime, there is great need for education in algorithm literacy, accountability processes, oversight and transparency and a reassurement that the algorithms' designers should be trained in ethics and required to design code that considers societal impact as it creates efficiencies and inequalities. Indisputably, a strategic foresight mindset and proper education of the students will intercept delusions, deadlocks, certain risks and faits accomplis lurking from the thoughtless development of LLM models.

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The End!

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ENVIRONMENTAL AND DIGITAL CITIZENSHIP:
FOSTERING YOUTH ENGAGEMENT FOR A SAFER
ENVIRONMENT AND RESPONSIBLE USE OF ICT